



Northumberland County
Implementation Plan
For the
Chesapeake Bay
Tributary Strategy

A. County Description

“Chesapeake Bay, the Nation’s largest estuary, has been adversely affected by nutrient enrichment. Excessive nutrients have caused eutrophication, contributing to periods of hypoxia (dissolved-oxygen concentrations lower than 1.0 mg/L) and poor water-clarity conditions that deprive living resources of necessary oxygen and sunlight.”(Sprague et. al. 2000) Freshwater source inputs come from a multitude of different sources, with the Susquehanna River contributing 50% of the freshwater to the Bay. Of the total streamflow into the Bay, the Susquehanna River contributes 60%. Of the total nutrient contribution to the Bay, the Susquehanna River contributes 62% of the total nitrogen and 34% of the total phosphorus.

Northumberland County, located at the junction of the North and West Branches of the Susquehanna River, is an area of diverse and unique land uses and cultures. With a total area of 460 square miles and a population of 94,428, Northumberland County is, for the majority, a rural county. With a little over 123,500 acres of farm land within the county limits, agriculture has always been and continues to be a substantial amount of the land use in Northumberland County. The culture of Northumberland County is just as diverse as its land use. The east central and west central parts of the county are mostly urban while the northern half of the county brings in some of the Amish community. Northumberland County contributes approximately 3 million pounds of total nitrogen, 73,000 pounds of total phosphorus and 24,000 tons of total sediment to the Bay each year. Tillage practices, forested areas and urban areas are the largest contributors to this load as can be seen in Appendix #1.

As mentioned earlier, agriculture is a large part of the economy and land use of Northumberland County. Ranking fourth in Pennsylvania for the production of corn grain and soybeans and fourteenth in the production of wheat, grain farming is a substantial component of the agriculture in the county. The types and sizes of the livestock operations vary greatly depending on their location within the county. The plan will go into further detail in a later section.

B. Water Resources/Quality

There are seven major water bodies and their associated watersheds within Northumberland County. Each of these water bodies have their own unique impairments due to the watersheds which impact them. Below is a list of each of these water bodies and their impairments, take note that these are in no order of significance. The charts are in appendix #2.

The Mahantango Creek, which forms the southern boundary of the county, has an associated watershed of 28,800 acres. At one time the Mahantango Creek was polluted by abandoned mine discharge. As a result of the efforts of the Mahantango Creek Watershed Association, the Commonwealth of Pennsylvania constructed a mine acid-neutralizing plant in the headwaters of the Mahantango in 1970. Capable of treating up to 32 million gallons of abandoned mine discharge per day, the plant has effectively neutralized acid mine discharge in the Mahantango and has enabled it to support trout and other aquatic life. The population of the watershed is listed at 3,975 people. The land use of the watershed consists mostly of agricultural operations at 15,840 acres (55%), 11,232 acres forested (39%) and 1,728 acres urban (6%). Two major soils associations are predominant in the agricultural areas of this watershed. The Weikert-Berks-Hartleton association is characterized as gently sloping to steep, shallow to deep, well drained soils on hills and ridges; formed in material weathered from shale and some sandstone. The Klimesville-Calvin-Leck Kill association is characterized as gently sloping to steep, shallow to deep, well drained soils on hills and ridges; formed in material weathered from red shale. The major soils associations in Northumberland County are delineated in Appendix #3. The average slope for the watershed is 16.2%. The creek is listed as a warm water fishery and is stocked with trout by the Pennsylvania Fish and Boat Commission. With these types of land use, the major forms of impairments come from non-point source pollution.

The Mahantango Creek has been listed on the 303D list due to siltation from removal of vegetation on agricultural operations. One of the main sources of nutrient and sediment loading comes from the livestock feeding areas/barnyards and the untimely and over application of manure to croplands. Also, since the grazed livestock operations in this watershed are mainly beef operations, impacts to stream banks, minimal buffers and overgrazed pastures are a main source of the nutrient and sediment runoff to the watershed's streams. Another source of non-point source pollution in the watershed comes in the form of conventional tillage and minimal cover crop planting. Due to the steep terrain (8-25% slope) and topography of the watershed, these two impacts produce a substantial amount of nutrient and sediment loading to the Mahantango Creek and its tributaries. The dirt and gravel roads of the Mahantango Creek Watershed are another area of concern. Taking into account the topography and the number of unimproved surfaces in the watershed we can see how these areas can be a major concern of sediment loading to the stream. The Mahantango Creek is part of the Tri-Valley Watershed Association coverage area.

The agricultural operations of this watershed consist mainly of grain production and livestock operations. An approximate breakdown by crop for the watershed is as follows;

Corn	47.2%	7,476 acres
Alfalfa and Hay	12.9%	2,043 acres
Set Aside	14.5%	2,297 acres
Small Grains	9.9%	1,568 acres
Soybeans	9.1%	1,441 acres
Pasture	4.7%	744 acres
Vegetables and Other	1.7 %	<u>267 acres</u>
Total		15,840 acres

There are currently 47 livestock operations in the Mahantango Watershed. An approximate breakdown by type of animal is as follows:

<u>Type of Operation</u>	<u># of Farms</u>	<u># of Animals</u>
Dairy	6	475
Swine	13	16,300
Poultry	8	590,000
Beef	15	1,300
Sheep	5	522

The second major watershed to be discussed is the Mahanoy Creek. With a total watershed area of 100,480 acres, this is one of the larger watersheds in the county. The stream flows east to west through East Cameron, West Cameron and Little Mahanoy townships. The land use for the area is broken down into 66,317 acres forested (66%), 21,101 acres agricultural (21%), 4,019 acres urban (4%) and 9,043 acres mine land (9%). The population of the watershed is listed at 38,824 people. The watershed for this creek includes land in Schuylkill County as well as Columbia County. Two major soils associations are predominant in the agricultural areas of this watershed. The Weikert-Berks-Hartleton association is characterized as gently sloping to steep, shallow to deep, well drained soils on hills and ridges; formed in material weathered from shale and some sandstone. The Klinesville-Calvin-Leck Kill association is characterized as gently sloping to steep, shallow to deep, well drained soils on hills and ridges; formed in material weathered from red shale. The major soils associations in Northumberland County are delineated in Appendix #3. The watershed has an average slope of 19.9%. The Mahanoy Creek is listed as a warm water fishery. Included in the watershed is Schwaben Creek which will be broken into a separate watershed later on.

The Mahanoy Creek has a completed TMDL and has been listed on the 303d list as impaired by abandoned mine drainage, siltation from crop related agriculture and atmospheric deposition. The major source of pollution in this watershed is due to abandoned mine drainage from 32 mine discharges with over half of these being considered large discharges (greater than 1.0 cubic foot per second). Agriculture impacts

of the watershed are located primarily on the lower reaches of the watershed. One of the main sources of nutrient and sediment loading from agricultural operations comes from the livestock feeding areas/barnyards and the untimely and over application of manure to croplands. Also, since the grazed livestock operations in this watershed are mainly beef and dairy operations, impacts to stream banks, minimal buffers and overgrazed pastures are a main source of the nutrient and sediment runoff to the watershed's streams. Another source of non-point source pollution in the watershed comes in the form of conventional tillage and minimal cover crop planting. Due to the steep terrain and topography of the watershed, these two impacts produce a substantial amount of nutrient and sediment loading to the Mahanoy Creek and its tributaries.

The agricultural operations of this watershed consist mainly of grain production and livestock operations. An approximate breakdown by crop for the watershed is as follows;

Corn	49.4%	10,424 acres
Small Grains	20.9%	4,410 acres
Set Aside	9.7%	2,047 acres
Alfalfa and Hay	7.6%	1,604 acres
Pasture	7.2%	1,519 acres
Soybeans	5.1%	1,076 acres
Vegetables and Other	0.1 %	<u>21 acres</u>
Total		21,101 acres

There are currently 7 livestock operations in the Mahanoy Watershed. An approximate breakdown by type of animal is as follows:

<u>Type of Operation</u>	<u># of Farms</u>	<u># of Animals</u>
Dairy	2	100
Swine	0	0
Poultry	1	30,000
Beef	4	300
Sheep	1	40

The third watershed to be discussed is the Schwaben Creek watershed. Schwaben Creek is a tributary to the Mahanoy Creek, but due to its drastically different land use, it has been decided to subdivide this stream into a separate watershed. The Schwaben Creek Watershed consists of 14,387 acres which is majority agricultural land. The land use breakdown for the watershed is as follows; 7,913 acres agriculture (55%), 5,899 acres woodland (41%) and 432 acres urban (3%). Two major soils associations are predominant in the agricultural areas of this watershed. The Weikert-Berks-Hartleton association is characterized as gently sloping to steep, shallow to deep, well drained soils on hills and ridges; formed in material weathered from shale and some sandstone. The Klinsville-Calvin-Leck Kill association is characterized as gently sloping to steep, shallow to deep, well drained soils on hills and ridges; formed in material weathered from red shale. The major soils associations in Northumberland County are delineated in Appendix #3. The watershed has an average slope of 14.8%. The creek is listed as a trout stocked fishery and is stocked with trout by the Pennsylvania Fish and Boat Commission.

The creek has been listed on the 303d list for agricultural impairment from siltation, low dissolved oxygen, and organic enrichment, siltation due to removal of vegetation, organic enrichment and low dissolved oxygen due to grazing related agriculture. One of the main sources of nutrient and sediment loading comes from the livestock feeding areas/barnyards and the untimely and over application of manure to croplands. Also, since the grazed livestock operations in this watershed are mainly beef

operations, impacts to stream banks, minimal buffers and overgrazed pastures are a main source of the nutrient and sediment runoff to the watershed's streams. Another source of non-point source pollution in the watershed comes in the form of conventional tillage and minimal cover crop planting. Due to the steep terrain and topography of the watershed, these two impacts produce a substantial amount of nutrient and sediment loading to the Schwaben Creek and its tributaries. The dirt and gravel roads of the Schwaben Creek watershed are another area of concern. Taking into account the topography and the number of unimproved surfaces in the watershed we can see how these areas can be a major concern of sediment loading to the stream.

The agricultural operations of this watershed consist mainly of grain production and livestock operations. An approximate breakdown by crop for the watershed is as follows;

Corn	49.4%	3,909 acres
Small Grains	20.9%	1,654 acres
Set Aside	9.7%	768 acres
Alfalfa and Hay	7.6%	601 acres
Pasture	7.2%	570 acres
Soybeans	5.1%	404 acres
Vegetables and Other	0.1 %	<u>7 acres</u>
Total		7,913 acres

There are currently 32 livestock operations in the Schwaben Creek Watershed. An approximate breakdown by type of animal is as follows:

<u>Type of Operation</u>	<u># of Farms</u>	<u># of Animals</u>
Dairy	5	395
Swine	6	1,850
Poultry	5	200,000
Beef	12	1,225
Sheep	4	75

The fourth watershed listed for the county is the Shamokin Creek watershed. The total watershed area is 87,680 acres. Shamokin Creek originates south east of Shamokin and flows east to west eventually discharging into the main stem of the Susquehanna River. The watershed consists of 45,594 acres of forested land (52%), 19,027 acres of agricultural land (21.7%), 13,706 acres of mine land (15.6%), 8,698 acres of urban land (9.9%) and 702 acres of wetland (.8%). Shamokin Creek is listed as a cold water fishery. Two major soils associations are predominant in the agricultural areas of this watershed. The Weikert-Berks-Hartleton association is characterized as gently sloping to steep, shallow to deep, well drained soils on hills and ridges; formed in material weathered from shale and some sandstone. The Klinsville-Calvin-Leck Kill association is characterized as gently sloping to steep, shallow to deep, well drained soils on hills and ridges; formed in material weathered from red shale. The major soils associations in Northumberland County are delineated in Appendix #3. The watershed has an average slope of 16.5%.

The creek has a completed TMDL as well as being listed on the 303d list for abandoned mine drainage, urban runoff, storm sewers, siltation and road runoff. With 63 mine discharges, abandoned mine drainage is the largest source of impairment to Shamokin Creek. Another impact on the watershed comes from sewage treatment, both public and private facilities. In the lower reaches of the watershed agriculture impairments begin to surface. One of the main sources of nutrient and sediment loading from agricultural operations comes from the livestock feeding areas/barnyards and the untimely and over application of manure to croplands. Also, since the grazed livestock operations in this watershed are mainly beef and dairy operations, impacts to stream banks, minimal buffers and overgrazed pastures are a main source of the nutrient and sediment runoff to the watershed's streams.

The agricultural operations of this watershed consist mainly of grain production and livestock operations. An approximate breakdown by crop for the watershed is as follows:

Corn	45.7%	8,695 acres
Soybeans	17.2%	3,273 acres
Small Grains	13.2%	2,512 acres
Alfalfa and Hay	10.0%	1,903 acres
Set Aside	6.9%	1,313 acres
Vegetables and Other	3.6%	685 acres
Pasture	3.4 %	<u>646 acres</u>
Total		19,027 acres

There are currently 24 livestock operations in the Shamokin Watershed. An approximate breakdown by type of animal is as follows:

<u>Type of Operation</u>	<u># of Farms</u>	<u># of Animals</u>
Dairy	6	400
Swine	7	7,000
Poultry	6	300,000
Beef	4	700
Sheep	1	35

The fifth watershed to be discussed is the Little Shamokin Creek Watershed. The total watershed area is 18,688 acres and consists primarily of agricultural operations, with the lower end turning to residential/urban. The land use breakdown for the watershed is as follows; 9,157 acres agricultural (49%), 8,036 acres forested (43%), and 1,495 acres urban (8%). Two major soils associations are predominant in the agricultural areas of this watershed. The Weikert-Berks-Hartleton association is characterized as gently sloping to steep, shallow to deep, well drained soils on hills and ridges; formed in material weathered from shale and some sandstone. The Klinsville-Calvin-Leck Kill association is characterized as gently sloping to steep, shallow to deep, well drained soils on hills and ridges; formed in material weathered from red shale. The major soil

associations in Northumberland County are delineated in Appendix #3. The watershed has an average slope of 13.0%. Included with this watershed are Boile Run, Hallowing Run and Sealholtz Run Watersheds due to their similarities in land use and population.

Little Shamokin Creek serves as the drinking water supply for the city of Sunbury. The creek originates south east of Sunbury and picks up the major tributary of Plum Creek just south east of Sunbury. It flows west/northwest until it discharges into Shamokin Creek. The stream is listed as a cold water fishery and is stocked with trout by the Pennsylvania Fish and Boat Commission. Little Shamokin Creek's major pollution concern comes from non-point source pollution. The stream is listed on the 303d list for siltation, organic enrichment and low dissolved oxygen due to agricultural related practices and it is also listed for siltation, low dissolved oxygen and organic enrichment due to livestock grazing related activities. From experience of working in the watershed, it is evident that one of the main sources of nutrient and sediment loading comes from the livestock feeding areas/barnyards and the untimely and over application of manure to croplands. Also, since the grazed livestock operations in this watershed are mainly dairy operations, impacts to stream banks, minimal buffers and overgrazed pastures are a main source of the nutrient and sediment runoff to the watershed's streams. Another source of non-point source pollution in the watershed comes in the form of conventional tillage and minimal cover crop planting. Due to the steep terrain and topography of the watershed, these two impacts produce a substantial amount of nutrient and sediment loading to the Little Shamokin Creek and its tributaries. Another area of concern involves private sewage handling facilities and their direct discharge into the stream. In the lower reaches of the watershed, where land use turns more urban, storm water and its related nutrient and sediment runoff becomes an area of concern.

The agricultural operations of this watershed consist mainly of grain production and livestock operations. An approximate breakdown by crop for the watershed is as follows;

Corn	45.7%	4,185 acres
Soybeans	17.2%	1,575 acres
Small Grains	13.2%	1,209 acres
Alfalfa and Hay	10.0%	916 acres
Set Aside	6.9%	632 acres
Vegetables and Other	3.6%	330 acres
Pasture	3.4 %	<u>310 acres</u>
Total		9,157 acres

There are currently 24 livestock operations in the Little Shamokin Watershed. An approximate breakdown by type of animal is as follows:

<u>Type of Operation</u>	<u># of Farms</u>	<u># of Animals</u>
Dairy	12	1,000
Swine	1	5,000
Poultry	3	200,000
Beef	2	250
Sheep	1	35

The sixth watershed is essentially a compilation of several small watersheds as well as one very extensive watershed. For the purpose of this plan, the watershed has been entitled the Chillisquaque/Limestone Run watershed. This watershed includes all of the sub-watersheds north of the northern border of Point Township. These watersheds were grouped together due to the fact that the land use for the entire area is mainly agricultural and these agricultural operations are mainly dairy milking facilities. Two major soils associations are predominant in the agricultural areas of this watershed. The Holly-Basher-Wheeling association is found along both the West and North branches of the Susquehanna River. These soils are nearly level to sloping, deep, very poorly drained to well drained soils on flood plains; formed in alluvial material and outwash deposits.

The Weikert-Berks-Hartleton association is characterized as gently sloping to steep, shallow to deep, well drained soils on hills and ridges; formed in material weathered from shale and some sandstone. This watershed encompasses 61,000 acres. The average slope for the watershed is 9.9%.

All of these watersheds are listed in the 303d list as agriculturally impaired. Other impairments to these watersheds include siltation, organic enrichment and low dissolved oxygen due to agricultural operations. Other impairments include industrial point source discharge, road runoff, habitat alterations, flow alterations and on site wastewater discharges. All of the streams in this watershed are listed as being warm water fisheries. One of the main sources of nutrient and sediment loading comes from the livestock feeding areas/barnyards and the untimely and over application of manure to croplands. Also, since the grazed livestock operations in this watershed are mainly dairy operations, impacts to stream banks, minimal buffers and overgrazed pastures are a main source of the nutrient and sediment runoff to the watershed's streams. Another source of non-point source pollution in the watershed comes in the form of conventional tillage and minimal cover crop planting. Due to the culture and topography of the watershed, these two impacts produce a substantial amount of nutrient and sediment loading to the Chillisquaque/Limestone Run watershed.

Another area of concern involves private sewage handling facilities and their direct discharge into the stream. Another point of interest is the Montandon Marshes which is listed as an exceptional value wetland. The Chillisquaque/Limestone Run Watershed Association is putting forth their best efforts to improve the condition of the Chillisquaque/Limestone Run watershed. A cooperative partnership has been formed between the watershed association, Milton Area School District, Pennsylvania Power and Light, Montour County Conservation District, Columbia County Conservation District and the Northumberland County Conservation District to combine efforts to clean up and conserve the watershed. A few of the efforts which have been initiated to date include stream clean-ups, a water quality assessment and a fish population assessment. Another important aspect of this watershed is the cultural issues which are present.

The seventh watershed to be covered is the North Branch of the Susquehanna River and the un-named tributaries which discharge into this section. This watershed encompasses 30,000 acres. The average slope for the watershed is 16.4%. All of the tributaries in this section are listed as cold water fisheries. One of the main sources of nutrient and sediment loading comes from the livestock feeding areas/barnyards and the untimely and over application of manure to croplands. Also, since the grazed livestock operations in this watershed are mainly dairy operations, impacts to stream banks, minimal buffers and overgrazed pastures are a main source of the nutrient and sediment runoff to the watershed's streams. Another source of non-point source pollution in the watershed comes in the form of conventional tillage and minimal cover crop planting. These two factors combine to equal very limited ground cover over the winter months which results in increased susceptibility to runoff. Another area of concern involves private sewage handling facilities and their direct discharge into the stream. Another area to consider in this watershed is urban nutrient management in the form of fertilizer and pesticide application on a golf course. The South Branch of Roaring Creek, although it is being included in this watershed, is listed as a high quality cold water fishery.

Erosion and sediment control continues to be a very important area of concern in all of the watersheds. Not only does this come into play in the agricultural operations as listed above, it is also a major area of concern in regards to development of the county's open and wooded areas.

One of the most important areas of concern when it comes to conserving the county's natural resources is that of education. Not only does it impact each and every watershed, it impacts each and every citizen of Northumberland County in one form or

another. Without this very important element, conservation would not have come as far as it has in Northumberland County. If the awareness of education expires in the future, the idea of conservation is likely to join it as well.

C. Trends of Significance to Water Quality

The population, economic, and land use trends within Northumberland County play a significant role in the water quality trends of the county. The population of the county, according to the 2007 census, is 91,948 people. A significant concern for water quality in the county is its close proximity to Harrisburg (34 miles) and Williamsport (24 miles). This could result in more impervious surfaces being established and possibly in an increased usage of urban fertilizer companies. This will require an increased emphasis being placed on urban nutrient management and erosion and sedimentation control efforts. Another concern that the establishment of these housing developments raises is the land which it is impacting, meaning the possibility of adversely impacting such things as previously forested land. The loss of this habitat for wildlife and established cover could possibly have a rather substantial impact on the rural landscape of the county as well as the water quality of our streams. The economic trends of the county are also an area of concern for the county's natural resources. Due to limited resources and lack of technical assistance time, fewer conservation practices are being constructed. Land use is also creating a pressing issue for conservation in the county. With the establishment of more housing developments, warehouses and industrial sites, as previously mentioned, will come the presence of more impervious surfaces, the need for an increased awareness and following of erosion and sedimentation control regulations and post-construction stormwater management.

Furthermore, agriculture in Northumberland County appears to be moving toward more industrious operating practices. Over the years, the number of farms in the county has decreased while the market value of production has increased. There has also been an increase of 4 percent in the average size of each farm.

With an increase in the size of an operation, better management becomes a requirement to continue to keep the farm profitable. Poor management on an operation that continues to increase in size will result in more opportunities for the operation to fail. The charts in appendix #4 show some of these trends for Northumberland County.

The types of livestock agricultural operations in the county seem to be divided by the Little Mountain which is located between Augustaville and Dornsife. North of the mountain, the operations consist mainly of dairy, poultry and hogs. South of the mountain the operations consist mainly of beef, swine and a few poultry operations. The swine and poultry operations both north and south of the mountain are primarily contracted operations and therefore tend to have very few nutrient and sediment related problems in regards to the livestock. A few of the problems that do arise with these types of operations is the storage of the manure and composting of dead animals. Without adequate manure storage facilities, the operators are forced to land apply the manure during times when the soil conditions are not suitable for an application, thus increasing the likelihood of nutrient laden runoff impacting the streams. Also, mortality composters are beginning to become a very popular practice for cost sharing thanks in part to education of the landowners in regards to the benefits composting can provide to them as well as to the county's water quality.

The beef operations in the southern end of the county bring forth a whole different set of non-point source pollution problems; mainly due to the topography of the area, the vast majority of the feeding areas/barnyards have a substantial impact on the watersheds. With the size of the operations averaging about 66 head per farm, each and every unimproved feeding area and barnyard poses a significant threat to the water quality. Nearly 40% of all livestock farmers with streams on their property have livestock holding areas within 100 feet of the stream. It is estimated that at least 80% of these farms are contributing polluted runoff to the streams from these holding areas. Some of the practices which are currently being used to correct these types of situations include heavy use area protection and some type of filter area below to treat any runoff water or heavy use area protection with a roofed structure to prevent water from directly impacting the

area. There is usually some type of upslope diversion associated with these two practices to prevent any clean water from impacting the barnyard. The two practices listed above are meant to provide a firm surface to feed animals on as well as providing an area to capture the manure so it can be properly applied to the croplands. Without any means to store the manure, manure application to cropland during unfavorable conditions (soils are frozen, ground is snow covered or saturated) is inevitable. Spreading manure on sloping soils which are frozen, snow covered or saturated presents a serious non-point source pollution problem that can only be solved by the installation of manure storage facilities on these types of operations. Approximately 40% of livestock operations in this area have inadequate manure storage facilities, therefore the majority of these farmers are spreading manure on a daily or almost daily basis.

Also associated with these types of operations is the need for streambank fencing and stabilization. The impact that 66 head of cattle can have on a stream bank can be quite devastating, leaving the area completely void of vegetation; therefore complete exclusion with an off stream watering source or very limited access to the stream area are ways to correct the problem at hand. Approximately 90% of the beef farmers in this area have streams on the farm. Of these 90%, approximately 60% of the farms have livestock with direct access to the streams. Pasturing in this area tends to be utilized on only one or two pastures which are often overgrazed. This practice renders the pasture void of vegetation and therefore provides no ability to retain any of the sediments and nutrients located or applied to the area. A rotational grazing system implemented on an operation like this would drastically improve the water quality of the surrounding streams.

The dairy operations in the north are similar to the beef operations of the south, in that they provide a whole diverse set of problems to tackle. The most important nutrient and sediment concern for these types of operations in Northumberland County involve waste management systems. These systems include the barnyards and the waste storage facilities. Most of these barnyards consist of unimproved surfaces. The two most

important practices that are currently being managed in this area are placing heavy use area fortifications on the affected area and utilizing a vegetated filter area to treat any runoff associated with the area. Generally, there is also some type of upslope diversion associated with these two practices to prevent clean water runoff from entering and impacting the barnyard. The average herd size of 66 animals per operation produces a substantial amount of manure to be handled on a daily basis; therefore waste handling tends to be an immense concern for this type of operation, due to the liquid consistency of the manure. The wastes generated on this type of operation not only include the waste produced by the livestock, but it also includes the waste generated by the washing of the milking facilities. Moreover, another nutrient and sediment concern on this type of operation concerns the pasturing of the livestock. The impact that 66 head of cattle can have on a stream bank can be quite devastating; consequently, complete exclusion with an off-stream watering source or very limited access to the impacted stream area are ways to correct the problem at hand. Also, a rotational grazing system implemented on an operation like this would significantly improve the water quality of the surrounding streams. There are a few operations in the county which are switching to an intensive rotational grazing system and minimizing the amount of crops which are planted. This new approach benefits the nutrient and sediment concerns on the cropland as well as the pasture.

The grain production in Northumberland County accounts for a very large part of the land use within the county. With the presence of 936 farms in the county, 20 concentrated animal operations (CAOs), and 7 concentrated animal feeding operations (CAFOs), most operations depend heavily on the crop production for both the livestock feed and the farm income. Most of the grain produced in the county consists of corn grain/silage and soybeans. This results in minimal ground cover during the winter months when the nutrients applied to cropland are most susceptible to runoff. The utilization of cover crops can greatly reduce the effects of runoff from these crop fields. Additionally, the establishment of strip-cropping, contour farming, diversions, waterways, and terraces can help to greatly reduce the amount of erosion during those times when the soil is most susceptible to erosion.

Nutrient management planning and conservation planning, on all agricultural land in the county, plays a very critical role in reducing the amount of nutrients and sediment which are impacting the waterways of the county. Nutrient management planning establishes the amount of nutrients which can be applied to cropland and therefore minimizes the over application of these nutrients. Conservation planning lays out the practices which will most effectively reduce erosion concerns on the agricultural land in the county. Both of these practices lay out the management practices which will minimize the impacts from the new and existing waste management systems.

Agricultural land preservation is a concern for all areas of Northumberland County. With the county being located in between Harrisburg and Williamsport, more and more agricultural land is lost each year to housing developments. The Agricultural Land Preservation Program is of very high interest to the agricultural operators of Northumberland County. There are currently 55 operations totaling 6,233 acres signed up to participate in this program. It would cost approximately \$10 million to purchase the easements of all 55 operations; therefore, due to limited funding, few agricultural land development rights are purchased each year. At the current trend, development rights for only one operation is able to be purchased every two years, on average. This trend is dependent on the size of the operation and available funds. To date 18 farms totaling 2,147 acres have been enrolled in the program. At an average cost of \$1,207 per acre, \$2,588,321 has been paid out in state and county funds in Northumberland County to purchase easements.

An area of nutrient and sediment concern for all construction and agricultural practices is erosion and sediment concern. With an average Earth disturbance acreage of approximately 416.7 development -acres per year being reported, the implementation of erosion and sediment control practices are extremely important in minimizing sediment laden runoff from entering the streams. The implementation of 102/105 practices can greatly reduce any erosion concerns on construction sites.

Another major concern for the quality of our county streams involves the county's 134 dirt and gravel road worksites. With a total of 90.25 miles of dirt and gravel roads in the county, sediment laden runoff from these sites is of concern to the water quality of the streams in the county. There are several practices that can be utilized in conjunction with one another to minimize the amount of sediment leaving the sites. The first of these practices would be to re-grade the actual road itself, to bring the surface back to original grade with the placement of a stable road base. Another practice is to improve the overall drainage of the road by analyzing the existing culvert pipes, under drains, turn outs, and determine if they are properly sized and placed to transfer storm water under the road. A third practice to be utilized would be diversions and waterways. These can be used to direct any surface runoff water to the culvert pipes and minimize any impact it may have on other stretches of the road. The fourth practice utilized is the placing of a driving surface aggregate (DSA). Placing the DSA on the crowned road surface will allow sheet flow off of the surface and reduce road material migrating to the streams. Using all of these practices in conjunction with one another or as stand-alone practices, could greatly reduce any erosion concerns to the dirt and gravel roads in the county.

Abandoned mine drainage continues to be a very serious concern for the water quality of two specific watersheds within the county. The first of these streams is Shamokin Creek and the second is Mahanoy Creek. Both of these streams and their associated watersheds have already been discussed in detail in a previous section. There are several types of treatment options which have already been utilized in the Shamokin Creek watershed. These treatment systems are constructed wetland/passive treatment system, vertical flow wetlands and diversion wells.

D. Sediment and Nutrient / Source Reduction

The county conservation district and its partnering agencies have in the past and continue to utilize a multitude of activities and programs to accomplish the conservation goals of Northumberland County. Through the many cost sharing programs and grant opportunities available to the landowners and organizations of the county, there has been great strides taken to conserve the natural resources of the county. In conjunction with these programs, education plays a very crucial rule in accomplishing the goals for the county. These different programs and activities will now be deliberated separately in regards to their accomplishments and effectiveness.

Non-point source pollution prevention has been a major target for cost-sharing opportunities in Northumberland County. Through the Chesapeake Bay Financial Assistance Program, the United States Department of Agriculture's cost share programs, DEP's Streambank Fencing Program, PDA and SCC's Nutrient Management Plan Implementation Grant Program, Agriculture-Linked Investment Program, Agricultural Land Preservation Program, and the Nutrient Management Plan Development Incentives Program, some of the non-point source pollution concerns have been minimized. While these cost-share programs are very critical to the implementation of best management practices on agricultural operations, the technical assistance provided to these landowners and projects through the NRCS, the Northumberland County Conservation District, Local Watershed Groups, Penn State Cooperative Extension and the Department of Environmental Protection is crucial to ensuring that these practices are implemented correctly. Without this assistance, many of the conservation practices installed on these operations would fail due to structural failure, improper sizing, and therefore cost sharing dollars would be wasted on practices with no environmental benefit.

The following is an estimated list of the non-point source agriculturally related accomplishments within the county listed by the practice type:

Practice	Units	# Accomplished
Animal Waste Management Systems	AEUs	8,631
Conservation Plans	Acres	73,296
Conservation Tillage	Acres	39,819
Forest Buffers	Acres	542
Grass Buffers	Acres	542
Land Retirement	Acres	9,958
Nutrient Management	Acres	26,980
Off-stream watering with stream fencing	Acres	394
Off-stream watering without stream fencing	Acres	48
Rotational Grazing	Acres	196
Tree Planting	Acres	711
Wetland Restoration	Acres	28

Although there has been a lot of progress made to date, there is still a lot that needs to be done in Northumberland County. With most of the county's watersheds still remaining on the 303d list for agricultural impairment, non-point source pollution is still a major concern for the water quality of Northumberland County. There are still existing areas of concern in relation to agricultural operations of the county. The future needs of the county, in regards to non- point source pollution from agricultural operations, are difficult to predict with the current agricultural economic trends. It is certain that the current non-point source pollution issues will remain concerns for conservation in Northumberland County for years to come. Whether or not the priorities remain the same is hard to say, but each of these concerns will need to be addressed.

Fortunately, in Northumberland County, all of the cost share programs are very strong and popular among the agricultural community. There is a long waiting list of interest in the different programs. The most effective approach to getting valuable practices installed on these operations would be to seek more sources of funding and then use the additional funding to address the highest priority concerns in the county's

watersheds.

Abandoned mine land reclamation and abandoned mine discharge remediation have been, and continue to be two areas of concern in Northumberland County. Technical and financial support is utilized from a multitude of sources. These sources can be found in appendix 6. There have been four treatment systems installed to date SCAR-48 (Henry Clay Stirling Mine Seep), SCAR-15 (Corbin Water Level Drift), SCAR-42 (Bear Valley Mine) and SCAR-23 (Big Mountain Mine No. 1). Unfortunately, the treatment system at SCAR-23 is not currently functional. The 3 working treatment systems account for 870 gal/min of water flow being discharged into Shamokin Creek. To date there has been 689 acres reclaimed in Northumberland County. Taking into account the long mining history of Northumberland County, 689 acres is quite a bit, but there is still quite a long way to go to have a significant impact on water quality.

The Chapter 102/105 regulations have created a role for local governments by coordinating issuance of building permits, notification to conservation districts of projects affecting one or more acres and provisions for program delegation to local government bodies. The regulations provided a five year phase-in period for implementing the erosion control plan requirement. The NCCD currently has Memorandums of Understandings (MOUs) with 24 municipalities (out of 36) and 1 MOU with the Northumberland County Commissioners. The District continues to update and add MOUs regularly.

The dirt and gravel roads in Northumberland County are a significant contributor of sediment laden runoff to the waters of Northumberland County. Funding for improvements to these roads is provided through the State Conservation Commission's Dirt and Gravel Roads Program, which assists townships and municipalities, both technically and financially, with improving the roads and minimizing runoff. To date there have been 22 projects completed with a total of 96,947 feet of dirt and gravel roads being improved. Due to a substantial increase in funding due to the passage of the Transportation Bill in 2013, which includes an addition of a Low Volume Roads component, the District anticipates a large increase in Dirt & Gravel Roads project

starting in 2015.

Education has always played a vital role in conserving the natural resources of Northumberland County. From formal group meetings to one-on-one meetings with individuals, education is the basis for conservation, and understanding how it will benefit the natural resources as well as the individual's operation, project, or life. Traditionally, the Conservation District, in partnership with Penn State Cooperative Extension, NRCS, PDA, SCC, DEP and FSA has sponsored and hosted three agricultural-related meetings. Each year one Winter Forum and one/two Twilight Meetings are held for the farmers of Northumberland County. These organized meetings, in conjunction with the one-on-one meetings, aid in the education of the county's landowners in regards to agricultural-related topics. A continuing effort each year is also placed on educating the school age children of the county on conservation issues and ways they can help conserve the natural resources of the county. Each year presentations are also given to children, teachers, contractors and farmers in regards to conservation.

E. County Bay Tributary Strategy

The 1987 Chesapeake Bay Tributary Strategy agreement set forth a non-point source pollution reduction goal of a flat 40% across the watershed. In order to better address the pollution issues at hand, the Department of Environmental Protection decided to use a bottoms up approach in setting goals for the 2003 agreement. These goals also established the number/amount of each practice which need to be implemented to meet the reductions in the tributary strategy. Setting these goals for each of the counties in the watershed allowed for a more defined and accountable approach for reaching the overall goals of the tributary strategy. The goals for Northumberland County can be found in Appendix #5.

Non-point agricultural pollution from Pennsylvania farmland has been identified as one of the largest sources of pollution to the Chesapeake Bay. Forty percent of the nitrogen and 21% of the phosphorus enter the bay from the Susquehanna River. Of these amounts, approximately 85% of the nitrogen and 60% of the phosphorus entering the Susquehanna River are from cropland.

Acting to reduce the flow of pollutants into the Susquehanna River and Chesapeake Bay, Pennsylvania initiated its Chesapeake Bay Program in 1984. The major thrusts of the Commonwealth's Chesapeake Bay Program are education and financial and technical assistance aimed at keeping soil and nutrients on the land. The program promotes the use of better farm practices, or BMP's on agricultural lands in the basin.

The purpose of this report is to assess the non-point source pollution concerns of Northumberland County. The report concentrates on (1) identifying non-point source pollution problems in the county, (2) determining the types and quantities of BMP's needed to reduce soil erosion and nutrient loss from cropland to acceptable levels, and (3) developing an effective plan of operation to guide the expenditure of cost sharing funds in the county.

The environmental impacts in Northumberland County can essentially be broken into five categories. These categories are Nutrient Management Systems, Abandoned Mine Treatment, Erosion and Sedimentation Control, Education and Regulation Enforcement.

Nutrient Management Systems involve all of the practices necessary to effectively capture and utilize the nutrients generated on the operation. These practices include such things as nutrient management plans, waste storage structures, heavy use area protection and streambank fencing.

From experience, only about 50% of the farmers in the county routinely soil test their crop land and only about 10% routinely test their manure. The resulting soil test levels show that approximately 25-30% of the crop land receives an over application of nutrients from a combination of both manure and commercial fertilizers. The development of nutrient management plans for farmers that sign contracts to receive cost share funding or technical assistance, through either the conservation district or NRCS, will result in a nutrient reduction of between 20 to 30 percent on each operation.

The other practices listed above, waste storage structures, etc. also play a large part in nutrient reductions on livestock operations. Approximately 40% of the livestock operations in the county have all of the critical BMP's implemented. The establishment of manure storage facilities, heavy use area protection, etc. will allow farmers with livestock to more fully take advantage of the nutrients in manure while reducing the potential for non-point source pollution. The implementation of these most critical BMP's will result in a reduction of 75% of nutrients and sediment being contributed to the bay from these operations. The numbers in appendix #9 represent the utilization of the waste from 90% of the county's livestock with a nutrient management system.

Abandoned mine treatment involves the treatment of both the mine discharges and the disturbed mine lands. With 95 current known discharges and only five of these being treated, 95% of the discharges remain to be remediated. The five discharges account for 35,861,309 gallons per day being treated and released into the waterways. The total amount of total mine discharge is 482,416,368 gallons per day for the three watersheds affected by abandoned mines. Comparing these two numbers, 92.5% of the discharge flow remains to be treated. There are currently 23,159 acres of abandoned mine land in Northumberland County. There has been 689 acres reclaimed to date, which leaves approximately 22,470 acres remaining to be reclaimed. An inventory of the abandoned mine land in Northumberland County can be found in Appendix #6. The implementation of treatment systems and the reclamation of the land will result in a 43% reduction of nitrogen, 38% reduction in phosphorus and a 50% reduction in sediment being contributed to the bay from the abandoned mine land.

E&S controls on construction projects and agriculturally tilled fields are very crucial to minimizing sediment laden runoff impact on the waterways of the county. In order to minimize these impacts, the best management practices associated with E&S controls must be installed correctly. On average 350 acres are treated with E&S controls each year. The installation of E&S controls will result in a 33% reduction in nitrogen, 50% reduction in phosphorus and a 50% reduction in sediment being contributed to the bay from the construction sites.

Education is extremely important in implementing the Chesapeake Bay Tributary Strategy. From Twilight Meetings for our agricultural community, to workshops for elementary and secondary level teachers, the Northumberland County Conservation District in cooperation with the various conservation groups, within the county and the various state agencies, strive to educate the public about conservation and its positive environmental impacts. The conservation district's goal for the future is to continue the educational efforts such as the ones previously mentioned, offer presentations in the area's educational facilities, and always be open to the realm of new and challenging ideas for educating the students, farmers, and residents of Northumberland County.

Cost share programs, best management practices and education can do a lot to conserve our natural resources. However, without enforcement of the existing regulations and program requirements, all of the time and money spent to put conservation practices on the ground mean nothing if existing polluters continue what they are doing. The Clean Streams Law, the Nutrient Management Regulations, National Pollution Discharge Elimination Systems permitting requirements, Chapter 102, Chapter 105, the Federal Surface Mining Control and Reclamation Act (SMCRA), etc. and all cost share program requirements have a profound effect on the water quality of the county. For conservation to continue to thrive in Northumberland County, enforcement of these regulations and requirements is imperative.

Appendix #7 lays out the different practices in use in Northumberland County and the various funding and technical resources available to implement them. The tables in appendix #9 show the practices that need to be completed in order to reach the goals in the 2003 agreement. This table also lays out the man hours required to effectively implement these goals and the costs involved with this implementation. The tables in appendix #10 show a detailed description of each of the Conservation District's technician's duties and responsibilities. Additionally, the accomplished tasks on this chart assume full cost share funding is received for implementation. If for any reason, cost share funding is not received, the quantity of implemented practices will decrease accordingly.

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Over all County Implementation Plan Goal

Reduce sediment and nutrient loading in Northumberland County's watersheds and ultimately the Chesapeake Bay through education and outreach, implementation of best management practices and program development.

Objectives for years 2010-2015

- Nutrient Management Plan development and reviews, 1,000 acres per year.
- Assist with 15 volunteer Manure Management Plans per year which include manure and soil tests.
- Interpret and assist with 1,000 acres of soil tests each year.
- Apply and administer grants for Best Management Projects on Agricultural operations such as growing greener, Bay Special Projects, REAP, NFWF.
- Reduce soil erosion and nutrient loss on 1,500 acres through implementation of best management practices (manure storages, diversion, waterways, strip cropping, no-till etc.).
- Calibrate at least 2 manure spreaders a year.
- Sign on at least 5 new cooperators a year.
- Encourage 200 new acres of cover crop each year through education, outreach and possible grant funding such as CBWI.
- Encourage 200 new No-till acres each year through education, outreach and possible grant funding.
- Establish 1,000 linear feet of stream bank buffers per year within Northumberland County watersheds including riparian (CREP) buffers.
- Hold at least 3 educational meetings for outreach efforts focusing on soil and water conservation relating to Agricultural Operations.
- Provide 1 annual report and two newsletters each year focusing on soil and water conservation.
- Stabilize 1000 linear feet of stream bank each year through fish habitats, rip rap, etc.
- Update and reassess volunteer watershed group Implementation plans every 2 years.
- Hold at least 1 education workshop per year focusing on watershed stewardship (i.e. rain barrels).
- Continue providing assistance to and networking with county watershed groups and project development and implementation.
 - SCRA, Chilli-Lime Association, Mahantango, Little Shamokin, Mahanoy, Roaring Creek, Tri-Valley
- Continue outreach efforts to Amish and Mennonite farms and provide support toward soil and water conservations efforts.
- Continue to administer the Agland Preservation program and preserve farms as funding allows.
- Assist schools with water quality monitoring and encourage more school districts to actively test and monitor streams and tributaries in their districts.
- Continue to participate with the Envirothon, an annual contest for students in Middle School and High School to participate in environmental issues.

- Continue providing oversight for E&S controls for projects and permits within the county.
- Administer the Dirt and Gravel road program as funding is available.
- Continue efforts to clean up Acid Mine Drainage pollution through the SCRA and Mahanoy Creek watershed groups by implementing and maintaining treatment systems as funding allows.
- Assist with illegal dump site cleanups within the county each year.
- Continue to work and combine efforts for soil and water conservation with neighboring agencies and County Districts. (NRCS, FSA, PSU Extension, ACCWT, DEP).
- Seek out new MOU's with Townships in the county to report building activities and direct E&S Controls (Memorandum of Understanding).
- Encourage and promote cooperating agencies' programs. (NRCS, FSA, PSU Extension, DEP).
- December of 2015, review goals and evaluate goals met, set new goals and objectives.
- Review goals and objectives on an annual basis.

*Update 1 (Approved by NCCD Board of Directors on May 6, 2010)

** Update 2 (Approved by NCCD Board of Directors on June 5, 2014)